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## A comparative analysis of interactional metadiscourse markers in the Introduction and Conclusion sections of mechanical and electrical engineering research papers

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### ABSTRACT

Academic writing, particularly writing research articles, is an indispensable part of every major in higher education. Hyland (2004) argued that a valuable means of exploring academic writing, and comparing the rhetorical features and preferences of different discourse communities, is through the metadiscourse analysis of the text. The present study examines the differences in the use, type, and frequency of interactional metadiscourse markers in the introduction and conclusion sections of research papers across the two disciplines of Mechanical and Electrical Engineering. To this end, 42 research articles (21 Mechanical and 21 Electrical Engineering) written by English native speakers were randomly selected from two major international journals. The current study made use of Hyland's (2005) model for analyzing the interactional metadiscourse markers used in the selected corpus, consisting of 41484 words. To analyze the data, the frequency, patterns of use, and type of interactional metadiscourse markers were elicited both through a manual corpus analysis and concordance package. Furthermore, to examine whether there is any significant difference in the use of metadiscourse markers in the introduction and conclusion sections of these papers, a Chi-square analysis was run. The results of the quantitative analysis revealed that although there were some minor differences in the frequency and type of these metadiscourse markers, there was no statistically significant difference across the disciplines, which can be attributed to the close nature of these fields. The findings of this study may render some pedagogical implications for ESP courses and especially writing research papers.

**Keywords:** metadiscourse markers; interactional features; research papers; academic writing; mechanical engineering; electrical engineering

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## Introduction

The term meta-discourse was originally coined by Harris (1970) and was later developed by Williams (1981). Metadiscourse is an umbrella and a fuzzy term which is easy to accept, though not easy to establish its boundaries (Swales, 1990; Nash, 1992). Some writers have restricted the term to the features of rhetorical organization by including only those text elements which refer to the text itself (Bunton, 1999; Mauranen, 1993a, 1993b; Valero-Garcés, 1996); while, others have narrowed the term to explicit illocutionary predicates (Beauvais, 1989). On the other hand, Hyland (2005; as cited in Fa-gen, 2012, p. 847; Abdi, 2011, p. 3) maintains that “generally, rhetoricians, applied linguists, and composition theorists agree on using metadiscourse in a wide sense, to refer to the various linguistic tokens employed to guide or direct a reader through a text so that both the text and the writer’s stance is understood” (p. 18).

Williams (1981, p. 212) defines meta-discourse simply as “writing about writing, whatever does not refer to the subject matter being addressed”. He claims that metadiscourse features provide a way of talking to the reader about the subject matter or propositional content. In other words, metadiscourse refers to one type of interaction between the reader and writer. As Vande Kopple (1985) defined, it is “discourse about discourse” and Crismore (1984) put it as “discouraging about discourse”. Instead of the term “metadiscourse”, other terms can be used which are proposed by other writers like “non-topical material” Lautamatti (1978), “metatext” ENkvist (1978), “gambits” Keller (1979) and “metatalk” Schiffri (1980). In a similar sense, Lautamatti (1978) and Meyer (1975) use the term non-content to refer to features of a discourse that do not add to or take away from the content or subject matter, but rather, help the reader to understand the content. Based on Richards and Schmidt (2010), metadiscourse markers (hereafter MDMs) are syntactically heterogeneous class of expressions containing words (however, still), phrases (in fact), or clauses (to make myself clear), that serve to monitor and organize ongoing discourse.

Metadiscourse features characterize the academic communities, through which writers of academic disciplines intrude into the texts and represent themselves and their readers in one way or another. Alternatively, Hyland (1998, p. 438, as cited in Intraprawat & Steffenson, 1995) asserts that “metadiscourse has been shown to be a critical feature of good ESL and native speaker student writing” by which the “writers for international scientific journals can also achieve intelligibility of communication through proper discipline norms, values, and assumptions to trail their path to academic promotions (Zarei & Mansoori, 2011, p. 43).

During the past ten years, the study of metadiscourse markers has turned into growth due to the interest in pragmatic and contextual aspects of utterances and interpretation in academic texts and many studies have been conducted too. Nonetheless, in comprehending texts, the sociocultural elements are one of the factors that may hinder interpretability. Making the writers’ intentions interpretable is another significant factor which should be considered. Hence as Ochola (2001) argues, any serious study of written discourse should consider the writers’ use of metadiscourse features as a means to logically organize the propositional content for textual cohesiveness (Hirose & Sasaki, 1994, p. 205), and to express messages of intentionality both at the interpersonal involvement and intrapersonal involvement levels.

Researchers have become increasingly aware of the fact that differences in the use of metadiscourse should be understood not only in relation to the national culture of the writer, but also in relation to the genre and the immediate discourse community to which the text is addressed. Although some research studies have been conducted by Abdi (2002), Blagojevic (2004), and Atai and Sadr (2008), there is still a dearth of research studies as for the use of metadiscourse markers in the research articles mainly focusing on the introduction and conclusion sections. This study is intended to bridge this gap by examining the kinds, frequency, and use of MDMs in the

introduction and conclusion parts of research papers in the field of Electrical and Mechanical engineering to develop the readers' awareness of how native speakers of engineering fields organize their writing.

### **Review of the Related Literature**

Hyland (2005) in his book "metadiscourse" mentioned that metadiscourse manifests the writers' or speakers' intention in the text and may contribute to the better transfer of the text's message. More importantly, metadiscourse suggests a framework for perceiving communication as a social engagement. Therefore, metadiscourse markers are used to make the comprehension of the text easier and according to many authors they have some information about the main text not the text itself. Beauvais (1989) put metadiscourse within speech act theory and defined metadiscourse as illocutionary force indicators that identify expositive illocutionary acts. He asserted that he borrowed the concept of illocutionary force indicators from Searle (1969), which means how a proposition is to be taken, and the expositive illocutionary act from Austin (1962), who argues that "acts of exposition involve the expounding of views, the conducting of arguments, and the clarifying of references" (p. 161), highlighting the fact that these acts are related to communicational situation. Accordingly, Beauvais asserted that metadiscourse has the function which Austin (1962) gives to expositives and manifests how a proposition or statement fits into the context of conversation, dialogue, and generally in context of exposition. In this sense, metadiscourse reveals the writer's communicative intent in presenting the discourse within a purposeful text. In his study, Beauvais provides a taxonomy of metadiscourse markers according to their form and function.

Conventionally, metadiscourse features have been divided into textual and interpersonal. However, Hyland (2004, 2005) and Hyland and Tse (2004) offered a more potent interpersonal view of metadiscourse: "all metadiscourse is interpersonal in that it takes account of the reader's knowledge, textual experiences, and processing needs [...]" (p. 161). By the same token, they are not in accord with the Hallidayan textual and interpersonal levels of discourse in which textual elements have encoding role, facilitating the development of discourse by letting the writers produce cohesive and coherent texts. It has also been mentioned that the role of textual elements depends on the propositional and interpersonal functions. Considering this point of view, texts are regarded as processes in which writers create propositional content and interpersonal engagement simultaneously. Therefore, the writers' linguistic choices have more than one function. Although Halliday's conception made contribution to theoretical background of metafunction, most of the researchers do not affirm the functional grammar as basis for metadiscourse investigations. But Hyland (2004, 2005) and Hyland and Tse (2004) view of metadiscourse is more in tune with Thompson's (2001) explanation of interactive and interactional resources being as two interrelated modes of interaction. Therefore, interpersonal elements of writing encompass both interactive metadiscourse features which organize the materials with regard to the readers' needs and expectations and interactional metadiscourse features which are intended to unite the writer and the readers together (Halliday, 1994).

Numerous metadiscourse models have been suggested (Adel, 2006; Crismore, 1989; Hyland, 2005; Vande Kopple, 1985, 2002). These models follow Halliday's (1994) tripartite conception of metafunctions which makes a distinction between the ideational elements of a text-the ways we encode our experiences of the world- its textual- ways by which the ideational and interpersonal meanings are actualized (Halliday 2007, p. 184), and interpersonal functions- ways to determine the "participatory function of language" (Halliday 2007, p. 184). Vande Kopple (1985) introduced the first taxonomy that led to a great deal of studies and novel taxonomies, although the categories are

vague and overlap functionally with each other. In other words, two leading categories of metadiscourse, namely the “textual, entailing the four strategies of text connectives, code glosses, illocution markers, and narrators” and “interpersonal, comprising the three strategies of validity markers, attitude markers, and commentaries”, were presented by him. Moreover, a revised model was proposed by Crismore et al. in 1993. In their model, the two major categories of textual and interpersonal remained the same, but the subcategories were divided into two categories of “textual” and “interpretive” markers in order to separate organizational and evaluative functions.

The next proposed model by Hyland (2005), classifies metadiscourse markers into two major categories of “interactive” and “interactional”. This model derives from Thompson and Thetela’s conception (1995), and it can be noted that the inclusion of stance and engagement markers has broadened its scope (Hyland, 2001a). The interactive dimension of metadiscourse (Hyland, 2005, p. 49), which concerns the writer’s attempts “to shape and constrain a text” in order to accommodate the readers’ interests and needs and set out a rational and proper argument, has been composed of five categories entailing transition markers, frame markers, endophoric markers, evidentials, and code glosses (Hyland, 2004). On the other hand, the interactional dimension of metadiscourse, which is concerned with “the readers’ involvement in the text (Hyland, 2005, p. 49)” and “the writer’s efforts to control the level of personality in a text and establish a suitable relationship to his or her data, arguments, and audience (Hyland, 2004, p. 139)”, entails the following five groups of markers.

- Hedges: Devices by which “the writer withholds full commitment to a proposition; employed as an index to recognize the alternative voices, viewpoints, and possibilities” (Hyland, 2005, p. 52).
- Boosters: Words which express certainty and highlight the force of propositions (Hyland, 2004).
- Attitude markers: Represent “the writer’s attitude and judgment of the propositional content (Hyland, 2005, p. 53).
- Engagement markers: Refer to addressing the readers explicitly, “either to focus their attention or include them as discourse participants” (Hyland, 2005, p. 53) through second person pronouns, imperatives, question forms, and asides (Hyland, 2001a).
- Self-mentions: Indicate the degree of explicit author presence and attendance in the text represented through the first person pronouns and possessive adjectives (Hyland, 2004; Hyland, 2005, p. 53).

The type and function of metadiscourse resources have been investigated in a number of different genres and contexts, including textbooks (Hyland, 1999), science popularizations (Varttala, 1998), advertisements (Fuertes-Olivera et al., 2001), newspaper discourse (Hempel & Degand, 2008; Le, 2004), academic talks and lectures (Eslami & Eslami-Rasekh, 2007; Pérez & Macià, 2002; Thompson, 2003), and research papers (Dahl, 2004; Hyland, 1998, 2001a, 2002, 2007; Mauranen, 1993a; Moreno, 1997; Mur Duenas, 2007; Zarei & Mansoori, 2007).

In addition, there are some studies which investigate the different kinds of metadiscourse markers and how they are used in different fields, languages, and different articles. A study by Abdi (2002) investigated the use of interpersonal metadiscourse markers in two fields of social sciences (SS) and Natural Sciences (NS) to illustrate the writers’ identity and their choices on the use of these markers. To study interpersonal metadiscourse, Abdi studied three markers as “attitude markers”, “emphatics”, and “hedges”. Through the analysis, it was found that SS writers used the interpersonal metadiscourse markers more than NS writers. Although there was a significant difference between the two majors in the use of hedges and attitude markers, the results showed that there were little differences in the use of “emphatics”. In another study, Bunton (1999) examined how Hong Kong research students use metadiscourse in their PhD theses. He asserted that scope and distance are major factors which determine the level of metatext reference. In his study, he compared two kinds of metatexts used in the theses: Higher level metatext references, which are used in larger amount of texts and lower level references, which refer to small amount

of texts and concluded that higher level metatext references were used more frequently to make the text more cohesive and coherent in comparison to their lower level counterparts.

To explore the effect of learners' language on the use of metadiscourse markers, contrastive studies revealed that first language as a factor can influence the type and amount of metadiscourse markers (Mauranen, 1993a). Crismore et al. (1993) did a contrastive study on the use of metadiscourse in American and Finnish students' persuasive writing. They focused on the amounts and types of the metadiscourse used by students and found that although both American and Finnish students used all categories and subcategories, there were some delicate differences in the amount and types of the items used. Another finding was that, Finnish and male students used more metadiscourse types than their American and female counterparts. Similarly, Faghih and Rahimpour's (2009) contrastive study of metadiscourse markers in applied linguistics research articles in English and Persian showed that conscious awareness of target language conventions of rhetorical functions is an influential factor in the use of metadiscourse. Likewise, the results indicated that interactive metadiscourse markers (transitions, frame markers) were used more frequently than interactional metadiscourse markers (like hedges, boosters, and attitude markers).

Dahl (2004) studied the use of metadiscourse markers in research articles. Dahl studied writings written by English, Norwegian, and French writers in three different disciplines of economics, linguistics, and medicine to see which factor, academic discipline or culture, impacted the use of metadiscourse mostly. It was found that language and culture factor was the most important in economics and linguistics since English and Norwegian writers made use of metatext more than French writers. On the other hand, in the field of medicine, national culture (i.e., native language writing culture) was manifested to be more important than language factor, because a fixed structure of introduction, method, results, and discussions is used globally. Another similar contrastive study was conducted by Blagojevic (2004) who studied the use of metadiscourse markers in academic articles which were written by Norwegian and English native speakers. He studied the writers' similarities and differences in the use of metadiscourse markers with different language and cultural backgrounds. The findings of this study revealed that although there were some delicate differences between English and Norwegian writers in the use of metadiscourse markers, the results were not statistically significant. The researcher found that the differences were discipline-specific rather than language or culture-specific. Moreover, Norwegian writers could write in English more confidently.

To find out what factors affect the use of metadiscourse markers, Burneikaite (2008) examined the use of metadiscourse markers in English L1 and L2 speakers' academic writings. Burneikaite reviewed their linguistics master's theses which revealed that the use of metadiscourse markers was similar in both languages and it was illustrated that the difference in the use of metadiscourse markers depends on some issues like mother tongue, the writers' cultural background, the writers' own specific style of writing, and the institutional commonalities and traditions. Furthermore, Atai and Sadr (2008) studied the effect of language and culture on the use of hedging devices in the discussion part of the linguistics research articles written by English and Persian native speakers. This contrastive study showed that there were significant differences in the use of hedging markers by English and Persian native speakers. It was revealed that English native speakers used a variety of different hedging devices in comparison to Persian native speakers.

Regarding the proper use of metadiscourse markers, Barton (1995) investigated the functions of metadiscourse markers in argumentative essays which include claims and counterclaims. In this study, the contrastive and non-contrastive functions of metadiscourse markers were considered. The findings revealed that the use of interpersonal metadiscourse markers which serve as contrastive and non-contrastive connections made counterclaims softer and put emphasis on claims.

A similar research study like the current investigation was done by Falahati (2006). Falahati reviewed the research articles' introduction and discussion sections to analyze the distribution of hedges in these sections/parts, and it was found that hedging distribution is not similar in these sections. It was reported that the discussion sections contain more hedging than the introduction. The reason for such a difference is that every section of a research article follows a special route and has a particular aim. The introduction section introduces the problem, provides some previous studies, and the reason to study the current issue while in the discussion section, all of the parts are summarized, calculated, and compared to other studies carried out in advance.

Despite the contribution of these studies to the area of metadiscourse, more studies are required to gain an in-depth understanding of the rhetorical structures and significance, distribution, use, and type of MDMs owing to the dynamic nature of MD across various disciplines and contexts. Moreover, such a study can raise the researchers' and writers' awareness of how to use metadiscourse markers effectively in their research papers. Accordingly, the present study seeks to fill the gap in the literature regarding the use of MDMs in the introduction and conclusion sections of research articles. In particular, the purpose of this study is to identify the discipline and nature of MD elements used in the engineering research articles' introduction and conclusion part. More importantly, this study made use of Hyland's (2005) model as a framework to find the type and number of MDMs used in the above-mentioned sections.

The current study aims to answer the following research questions:

1. How does the use of metadiscourse markers employed in the introduction section differ in the mechanical and electrical engineering research papers?
2. How does the use of metadiscourse markers employed in the conclusion section differ in mechanical and electrical engineering research articles?
3. Is there a statistically significant difference in the use of metadiscourse markers in the introduction section of the mechanical and electrical engineering research articles?
4. Is there a statistically significant difference in the use of metadiscourse markers in the conclusion section of mechanical and electrical engineering research articles?
5. If so, to what extent is the use of metadiscourse markers in the introduction and conclusion sections different or similar in the articles written in the field of electrical and mechanical engineering?

## **Method**

### *Corpus*

This study was an attempt to examine the type, frequency, and differences of metadiscourse markers employed in the introduction and conclusion sections of Mechanical and Electrical engineering papers. The corpus of this study comprised of 41484 words extracted from forty-two research articles of hard sciences, twenty one in the field of Electrical Engineering, which were selected from the Native English authors' journals. The same number of research articles was selected from Mechanical Engineering journals written by English native authors as well. It is important to note that detailed information of the authors was extracted from their bio-data and

resume using electronic databases. Table 1 demonstrates the descriptive statistics for the corpus by the two disciplines examined in this study.

Table 1  
Descriptive statistics of the corpus

	<b>Research Articles N</b>	<b>Number of Words</b>	<b>Mean of Words per Article</b>
<b>Electrical Engineering</b>	21	20700	3500
<b>Mechanical Engineering</b>	21	20784	3520
<b>Total</b>	42	41484	7020

All the articles were selected from recent issues of high-impact factor and peer-reviewed international journals of IEEE Transactions on Applied Superconductivity and International Journal of Mechanical Sciences. They were written by both male and female researchers of the fields, including university lectures, students, or both on diverse technical topics, such as power distribution, DC-transport properties of QMG current limiting elements, real-time monitoring of the laser hot-wire welding process, digital speckle-based strain measurement system for forming limit diagram prediction, to increase the external validity of the results. Such conscientious attention toward the topics is owing to the fact that the type and frequency of the linguistic elements such as metadiscourse markers in a given text may be considerably influenced by the topic of the text (Dafouz-Milne, 2003; Thompson, 2001). In selecting the above-mentioned articles, the researchers paid close attention to three criteria proposed by Nwogu's (1997) which are representativeness, reputation, and accessibility. Therefore, those articles which were almost representative of the genres being investigated and had a distinct section of introduction and conclusion were chosen so that the study could be conducted more delicately. Considering the reputation feature, the research articles were chosen from those English journals which had a strong international reputation. Finally as to the accessibility criterion, the articles were picked from among the most accessible and reliable journals. It is important to note that all the articles were selected randomly in order to increase the reliability of the research. The rationale for random sampling is that it would help the researchers control the particularity and idiosyncrasy of the writers' styles. However, those studies whose introduction and literature review were merged, or did not have a discrete section of introduction and conclusion, were discarded.

### *Theoretical Framework*

Several metadiscourse models have been proposed since the introduction of the concept. However for the purpose of this study, Hyland's (2005) interactional model of metadiscourse markers (as introduced earlier in the literature review section), which was a recent metadiscourse classification, was employed in the present study. This model is comprised of the two dimensions of interaction: interactive and interactional. To address the research questions, the present investigation focused on the interactional dimension which in particular involves the use of hedges, boosters, and attitude markers. The extended list of these markers and the instances can be found in the appendices' section (See Appendix A and B).

### *Data Collection Procedures*

In order to investigate the distribution of interactional metadiscourse markers in the introduction and conclusion sections of the research articles, a manual corpus analysis was carried out primarily to provide a qualitative and comprehensive picture of how metadiscourse markers are used in the specific genre of academic writing in the Electrical and Mechanical engineering fields by native English writers. To this end, the corpus was examined for all instances of interactional metadiscourse markers listed by Hyland (2005). For the analysis of the aforementioned categories, the whole corpora were examined word by word, rather than selecting a number of typical hedges, boosters, etc. from a list. Following Crismore et al. (1993), since the size of the introduction and conclusion sections across the fields is inevitably unequal, the frequency of metadiscourse markers was calculated per 1,000 words to make the length of the texts consistent and ensure the comparability of the results. After determining the types of metadiscourse markers employed in the introduction and conclusion sections of the sample articles, the gleaned data were quantitatively analyzed in order to identify their frequency of occurrence in the texts and examine whether there was a statistically significant difference between the two sets of corpus data.

### *Data Analysis Framework*

Both quantitative and qualitative analyses of the interactional metadiscourse markers, identified in the corpus, were carried out. To answer the first question of the study, a manual corpus analysis was run to find the frequency of each metadiscourse marker in the introduction and conclusion section of both engineering majors. The data was analyzed by the researchers of this study to avoid any mistakes in detecting and calculating the number and type of metadiscourse markers in the whole corpus. The inter-rater reliability of the coders was measured, which was .88 indicating a good reliability index. Likewise, a concordance package was employed to reexamine the type and number of the markers. To answer the second research question, after content analysis and frequency count, a Chi-square test was run to examine if there are any statistically significant differences in the use of metadiscourse markers in the Mechanical and Electrical engineering research papers (introduction and conclusion sections). The rationale for running a Chi-square test was that the metadiscourse markers employed in the selected articles enjoyed a normal distribution. It is important to note that the quantitative analysis was done using the SPSS software version 21.

## **Results and Discussion**

To answer the first research question, as to how metadiscourse markers are employed in the introduction section of the mechanical and electrical engineering research articles, the researchers did a frequency count in the research articles' introduction section. In other words, the instances of each type of interactional metadiscourse markers (i.e., Hedges, Boosters, and Attitude Markers) were detected, coded, and then counted to assess their distribution. The following table (Table 2) reveals the types, frequency, and percentage of the metadiscourse markers employed in the introduction section of the Electrical and Mechanical Engineering (EE, ME) research articles.

Table 2

Frequency and proportion of MDMs used in the introduction section of the EE and ME Research Articles

Types and Mean Use of Metadiscourse Markers	EE f of MDMs	Percent	ME f of MDMs	Percent
Attitude Markers	13	4%	24	8%
Boosters	44	15%	117	39%
Hedges	42	14%	85	28%
Mean Use	33	11%	75.33	25%

As Table 2 shows, the frequency of the three types of metadiscourse markers (attitude markers, boosters, and hedges) was measured in the introduction section of these papers. Interestingly, the use of metadiscourse markers were more frequent in the introduction section of Mechanical Engineering research articles in general, with the boosters (39%) to have the most frequent use in particular. This suggests that Mechanical Engineering researchers tend to emphasize on what they have found with certainty and convince the readers what they have accomplished. Likewise the use of hedges, with 85 instances (28%) found in the introduction section of the mechanical engineering studies, was more frequent compared to 42 samples (14%) measured in the electrical engineering articles. However, based on the information presented in the table, attitude markers were the least frequent metadiscourse marker type used by both majors (ME representing 8% and EE 4%) with the least use in the Electrical Engineering research articles which shows that engineering majors have little interest in using attitude markers in their paper writing and instead preferring to write more based on the facts employing a strong tone. In sum, boosters were found to have the highest proportion of use among the various types of MDMs employed in the introduction section of Mechanical Engineering research articles (39%), followed by hedges (28%), and finally attitude markers which came last (8%) in this regard. For a better presentation of the MDMs employed in the Mechanical and Electrical Engineering, a Bar Chart has been provided in Figure 1 below.

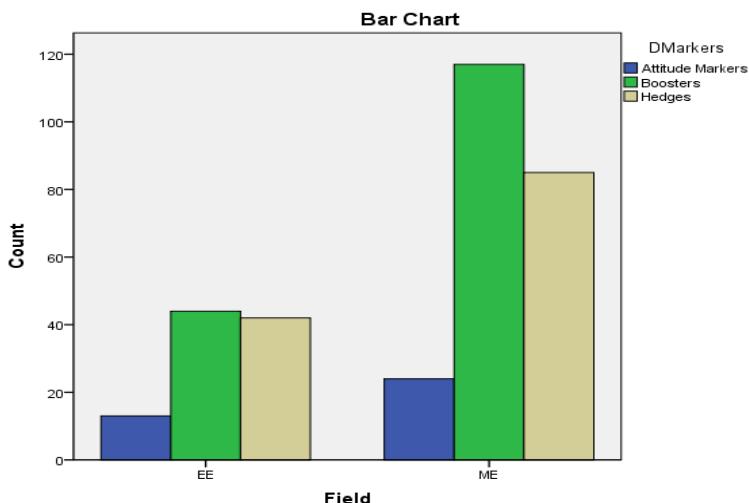


Fig. 1. Frequency of Metadiscourse Markers employed in the introduction section of the Electrical and Mechanical Engineering research articles

To answer the second research question of the study, which focuses on how metadiscourse markers are employed in the conclusion section of the mechanical and electrical engineering research articles, the frequency and proportion of use of the aforementioned MDMs were estimated and the following results were obtained as shown in Table 3.

Table 3

Frequency and proportion of MDMs employed in the conclusion section of the EE and ME Research Articles

Types and Mean Use of Metadiscourse Markers	EE f of MDMs	Percent	ME f of MDMs	Percent
Attitude Markers	7	6%	4	3%
Boosters	40	34%	37	32%
Hedges	20	17%	14	12%
Mean Use	22.33	19%	18.33	15%

Contrary to the results of the introduction section, here the use of metadiscourse markers was more frequent in the conclusion section of Electrical Engineering research articles. As the results disclose, boosters (with 40 instances found, 34%) were again the most frequently used metadiscourse markers, utilized in the conclusion section of the Electrical Engineering articles. This result may be owing to the tendency of engineering majors to use more emphatic language to prove their claims. Similarly, hedges were the second most frequently used MDMs (17%) employed in the electrical engineering research papers. Interestingly, attitude markers (with 6%) were again the least frequent MDMs employed in the conclusion section of both the Electrical and Mechanical Engineering articles with EE papers revealing three percent more use in their conclusion section compared to ME studies. To sum up, the highest proportion of use among the various types of MDMs employed in the conclusion section belonged to the boosters found in the Electrical Engineering research articles (34%), followed by hedges (17%), and finally attitude markers which had the lowest proportion of use (6%) among the examined MDMs. Fig. 2 displays that the Electrical Engineering research articles used these interactional MDMs more frequently than the Mechanical Engineering papers in their conclusion section.

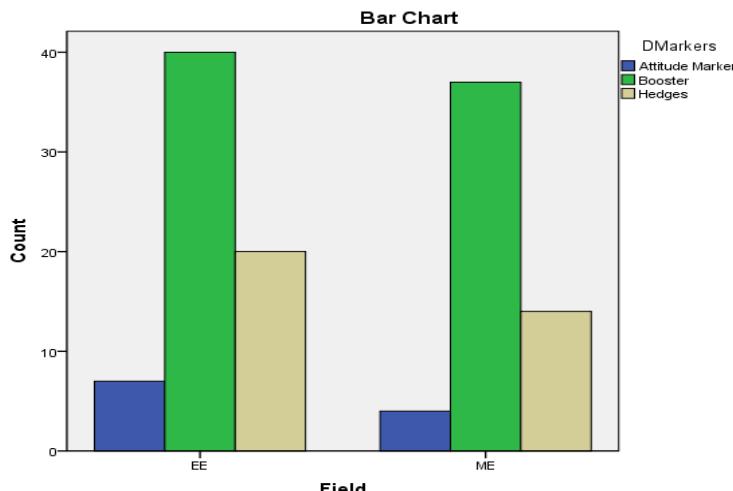


Fig. 2. Frequency of Metadiscourse Markers employed in the conclusion section of the Electrical and Mechanical Engineering research articles

The third and fourth research questions of the study examine if there are statistically significant differences in the use of metadiscourse markers in the introduction and conclusion sections of mechanical and electrical engineering research articles. To respond the third research question primarily, a Chi-Square test was run to determine if mechanical engineering articles had used a different type and number of metadiscourse markers in the introduction section of their research articles. The obtained results (see table 4) revealed that there was not a statistically significant difference between mechanical and electrical engineering use of metadiscourse markers in the introduction section,  $\chi^2(2, N=325) = .464, p>.05$ .

Table 4

Results of Chi-square test for examining the differences in the use of MDMs in the introduction section across disciplines

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.535 <sup>a</sup>	2	.464
Likelihood Ratio	1.535	2	.464
Linear-by-Linear Association	.085	1	.771
N of Valid Cases	325		

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 11.27.

To examine the fourth research question, alternatively another chi-square test was run to explore if there is any statistically significant difference in the application of metadiscourse markers in the conclusion section of Mechanical and Electrical Engineering research articles. As it can be seen in Table 5, the results revealed that there was not a statistically significant difference between the use of metadiscourse markers in the conclusion section of the Electrical and Mechanical Engineering research articles,  $\chi^2(2, N = 122) = .663, p>.05$ .

Table 5

Results of Chi-square test for examining the differences in the use of MDMs in the conclusion section across disciplines

	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	.822 <sup>a</sup>	2	.663
Likelihood Ratio	.828	2	.661
Linear-by-Linear Association	.013	1	.908
N of Valid Cases	122		

a. 1 cells (16.7%) have expected count less than 5. The minimum expected count is 4.96.

Accordingly, the aforementioned results can account for the extent to which the use of metadiscourse markers in the introduction and conclusion sections is different or similar in the articles written in the field of electrical and mechanical engineering. As the results suggest there is a great deal of similarity and minor difference in the use of interactional MDMs in the introduction and conclusion sections of the two engineering majors. Generally, it was found that both fields made use of the three metadiscourse marker types (attitude markers, boosters, and hedges) in the introduction and conclusion sections of their papers. Although there might be minor differences in the number and type of the metadiscourse markers used in these two majors, the obtained results were not statistically significant.

The overall results of this study support Rashidi and Alihosseini's (2012) study who examined the difference in the use and frequency of metadiscourse markers in the abstracts of 20 research articles in the field of sociology and engineering. The obtained results revealed no statistically significant difference in the use of metadiscourse markers across the selected disciplines. Moreover, such results are in line with the findings of Blagojevic's (2004) study which demonstrated no statistically significant difference in use of metadiscourse markers in the academic research papers between English native and non-native speakers. However, the current results do not concur with Atai and Sadr's (2008) study which showed a statistically significant difference in the use of hedging markers in the academic writings of English native and non-native speakers in applied linguistics research studies. Similarly, Abdi's (2002) study on the type and application MDMs (hedges, emphatics, and attitude markers) in the two majors of Social Science (SS) and Natural Sciences (NS) revealed a statistically significant difference between the majors where SS writers used MDMs in a different amount and type.

### Conclusions and Implications

Hyland (2005, p. 98) holds that interactional metadiscourse elements play a crucial role in contributing new knowledge and "making academic claims". The current study made an attempt to compare the use of Metadiscourse Markers in the introduction and conclusion sections of the research articles in the two fields of Mechanical and Electrical Engineering. The framework employed in this study was the model of metadiscourse markers proposed by Hyland (2005). Moreover, for the data collection and analysis, the researchers utilized frequency counts (descriptive statistics) and two Chi-square tests to examine the differences between the two fields in terms of their use of MDMs in the introduction and conclusion sections of their research articles. Following these analyses, a set of conclusions is drawn by revisiting the major issues involved in this study and implications are suggested for ESP (English for Specific Purposes) and EFL teachers in diverse research contexts.

Findings manifested that metadiscourse markers play a significant part in both ME and EE academic writings as they both took advantage of MDMs in the introduction and conclusion sections of their papers highlighting the significance of interactional functions of language in the academic discourse. The central finding of this study was that boosters were the most frequent metadiscourse markers used in both Electrical and Mechanical Engineering papers which further demonstrated the writers' tendency for intensifying the effects of the results they find and persuading the readers that their findings are logical and true. According to Hyland (1998), boosters are used to "mark involvement and solidarity with an audience" when expressing conviction, facts, and ideas. Similarly, hedges were the second most frequently used MDMs employed in the research papers, although their distributions varied across the disciplines and examined sections. Although such a finding reveals the ME and EE writers' willingness to tone down their theories, ideas, and claims, it does not support Hyland's (2000) suggestion that hedges are highly frequent in academic writing and are more frequent than one in every 50 words. In spite of boosters, attitude markers were found to be the least frequent metadiscourse markers utilized in the introduction and conclusion sections of the above-mentioned research articles. The reason for such a trend, not easy to explain, is rooted in a variety of cultural, social, and psychological factors represented in the writings across the disciplines.

More importantly, although there might be minor differences in the type and amount of metadiscourse markers used in the introduction and conclusion sections of these two majors, statistical procedures didn't evince any significant difference between them. In other words, there is not much difference in the use of MDMs in the introduction and conclusion sections across the disciplines. The reason for such a trend and high application of MDMs in Electrical and Mechanical Engineering research papers can be attributed to the close nature of these fields.

The findings of this study may render some pedagogical implications, especially for ESP academic writing practices. According to Hellermann and Vergun (2007), there is a correlation between the learners' proficiency level and appropriate use of MDMs. In other words, more proficient learners make more use of MDMs in their writings to make it cohesive and coherent. Hence, making students familiar with the rules of academic writing may improve the way they use MDMs in their academic writings. This familiarity can be gained through direct or indirect instruction during which, different kinds of genres, metadiscourse markers, and the required strategies to employ them may be introduced in different contexts. This awareness-raising through instruction will lead to successful "membership in the academic and professional discourse community" (Hyland, 1994, p. 244).

Accordingly, students are highly required to become well-acquainted with the techniques leading to further cohesion and coherence in the text. In particular, the instruction and analysis of the texts focusing on the genres and interactional metadiscourse markers employed in different contexts can help students to better organize their texts and guide their readers. Comparative metadiscourse studies, such as the one presented here, can also assist ESP and foreign language researchers, teachers, and learners in increasing their awareness of English writing conventions and determining the potential problematic areas and the right application of MDMs as they are used in various contexts.

There are a number of aspects of MDMs that can be explored in future research studies to further understand their nature as an interactive and interactional resource. It is worth mentioning that the corpus used in this study comprised of 42 research articles, picked from a limited number of journals, which might be considered a small corpus. It is suggested that this study be replicated with a larger corpus to have more generalizable findings. In addition, researchers can examine the application of all types of MDMs in various texts, other rhetorical sections, and contexts to determine the authors' level of awareness of the conventions of writing in various genres.

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## Appendix A

### *Taxonomy of Metadiscourse in Academic Texts (Hyland, 2005)*

Category	Function	Examples
<b>Interactive Metadiscourse</b>		
Transitions	Express semantic relation between main clauses	in addition, but, therefore, thus, and
Frame Markers	Explicitly refer to the text stages	finally, to repeat, our aim, here, we try
Endophoric Markers	Refer to information in other parts of the text	noted above, see Fig 1, table 2, below
Evidentials	Refer to source of information from other texts	according to X/Y, 1990 / Z states
Code Glosses	Help reader grasp meanings of ideational material	namely, e.g., in other words, such as
<b>Interactional Metadiscourse</b>		
Hedges	Withhold writer's full commitment to statements	might, perhaps, it is possible
Boosters	Emphasize force of writer's certainty in message	in fact, definitely, it is clear, obvious
Attitude Markers	Express writer's attitude to prepositional content	surprisingly, I agree, X claims
Engagement Markers	Explicitly refer to/build relationship with reader	frankly, note that, you can see
Self-Mentions	Explicitly reference to author(s)	I, we, my, mine, our

## Appendix B

### *Instances of Metadiscourse Markers*

#### **Attitude markers**

!, admittedly, agree, agrees, agreed, amazed, amazing, amazingly, appropriate, appropriately, astonished, astonishing, astonishingly, correctly, curious, curiously, desirable, desirably, disappointed, disappointing, disappointingly, disagree, disagreed, disagrees, dramatic, dramatically, essential, essentially, even x, expected, expectedly, fortunate, fortunately, hopeful, hopefully, important, importantly, inappropriate, inappropriately, interesting, interestingly, prefer, preferable, preferably, preferred, remarkable, remarkably, shocked, shocking, shockingly, striking, strikingly, surprised, surprising, surprisingly, unbelievable, unbelievably, understandable, understandably, unexpected, unexpectedly, unfortunate, unfortunately, unusual, unusually, usual.

#### **Boosters**

actually, always, believe, believed, believes, beyond doubt, certain, certainly, clear, clearly, conclusively, decidedly, definite, definitely, demonstrate, demonstrated, demonstrates, doubtless, establish, established, evident, evidently, find, finds, found, m fact, incontestable, incontestably, incontrovertible, incontrovertibly, indeed, indisputable, indisputably, know, known, must (possibility), never, no doubt, obvious, obviously, of course, prove, proved, proves, realize, realized, realizes, really, show, showed, shown, shows, sure, surely, think, thinks, thought, truly, true, undeniable, undeniably, undisputedly, undoubtedly, without doubt.

#### **Hedges**

about, almost, apparent, apparently, appear, appeared, appears, approximately, argue, argued, argues, around, assume, assumed, broadly, certain amount, certain extent, certain level, claim, claimed, claims, could, couldn't, doubt, doubtful, essentially, estimate, estimated, fairly, feel, feels, felt, frequently, from my perspective, from our perspective, from this perspective, generally, guess, indicate, indicated, indicates, in general, in most cases, in most instances, in my opinion, in my view, in this view, in our opinion, in our view, largely, likely, mainly, may, maybe, might, mostly, often, on the whole, ought, perhaps, plausible, plausibly, possible, possibly, postulate, postulated, postulates, presumable, presumably, probable, probably, quite, rather x, relatively, roughly, seems, should, sometimes, somewhat, suggest, suggested, suggests, suppose, supposed, supposes, suspect, suspects, tend to, tended to, tends to, to my knowledge, typical, typically, uncertain, uncertainly, unclear, unclearly, unlikely, usually, would,